

10/532085

JC1 Rec'd PCT/PTC 21 APR 2005

INFORMATION DISCLOSURE STATEMENT PTO-1449		Atty. Docket No. LAIN-089	Serial No. Not assigned
		Applicant: Petri SILENIUS et al.	
		Filing Date: April 21, 2005	Group: Not assigned

U.S. PATENT DOCUMENTS

Examiner's Initial		Document No.	Date	Name	Class	Sub Class	Filing Date If appropriate
	UA						
	UB						
	UC						
	UD						
	UE						
	UF						
	UG						

FOREIGN PATENT DOCUMENTS

Examiner's Initial		Document No.	Date	Country	Translation Yes/No/Partial
<i>RL</i>	FA	97/01670 A1	01/16/97	WO	
<i>RL</i>	FB	0 935 020 A1	08/11/99	EP	
<i>RL</i>	FC	02/092909 A1	11/21/02	WO	
	FD				
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	FF				
	FG				

OTHER DOCUMENTS

Examiner's Initial		
	DA	
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	DC	

Examiner:	<i>Ronnie Rachay</i>	Date Considered:	<i>9/13/07</i>
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PAPER SCIENCE AND PAPER MANUFACTURE

BEST AVAILABLE COPY

TYPES OF PAPER, THEIR APPLICATIONS AND THE PROPERTIES REQUIRED FOR THE PRINCIPAL CONVERTING PROCESSES

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APPLICATIONS & Grades		Composition ¹				Grammage g/m ²	Density kg/m ³	Roughness PPS-10µm or (Bendtaen mm/min)		Brightness %	75° Gloss %	Opacity R ₀ /R _m %	Tensile Index MD/CD Nm/g	Tear Index MD/CD Nm/kg	Air Permeance µm/Pas	Other Properties ²
		Furnish % Mech ³	% Chem	Filler %	Coat Wgt g/m ² Sides			Bendtaen mm/min	mm/min							
NEWSPAPERS	Newsprint ⁴	70 - 100	30 - 0	0 - 16	-	40 - 48.8	600 - 700	2.6 - 4.2	57 - 60	-	90 - 94	45-60 / -	- / 5 - 7	1.5 - 4.5	DF 1 - 3 SI 0.05 - 0.15	
BOOKS/MAGAZINES	Mechanical Papers	70 - 100	30 - 0	0 - 20	-	50 - 80	-	-	85 - 78	-	87 - 85					
CATALOGUES	SCC	30 - 80	70 - 20	0 - 7	-	45 - 60	-	1.7 - 2.6	85 - 85	25	85 - 92	45-50 / -	- / 4			
	SCB ⁵	30 - 80	70 - 20	8 - 15	-	45 - 60	800 - 900	1.5 - 1.9	85 - 85	35	85 - 92	45-50 / -	- / 4	0.18 - 0.36		
	SCA ⁶	30 - 80	70 - 20	16 - 30	-	45 - 60	900 - 1000	1.1 - 1.4	85 - 85	46	85 - 92	45-50 / -	- / 4	0.12 - 0.18		
COMMERCIAL PRINTING	C5	45 - 55	55 - 45	4 - 12	4 - 15	42 - 80	1050 - 1200	-	88 - 72	50 - 58	87 - 90	50-70 / 20-30	3 - 6 / 4 - 7			
	LWC (C5)	50 - 70	50 - 30	7 - 17	4 - 15	42 - 80	1000 - 1100	0.9 - 1.9	88 - 75	30 - 70 ⁷	85 - 92					
	C4	50	50	4 - 12	7 - 17	50 - 70	-	-	72 - 78	60 - 65	80 - 94	50-70 / 20-30	3 - 6 / 4 - 7			
BOOKS	C3	0 - 20	100 - 80	10 - 20	11	75 - 150	-	-	76 - 82	63 - 72	80 - 85	50-70 / 20-30	3 - 6 / 4 - 7			
BROCHURES	MWC			15 - 25		70 - 135	1000 - 1300	0.8 - 1.4	74 - 78	30 < 80 ⁷						
	C2	0	100	- 20	25 - 35		1000 - 1300	0.8 - 1.4	78 - 82	30 < 80 ⁷	95 - 98			- 0.01		
	C1	0	100	- 20	25 - 35		1000 - 1300	0.8 - 1.4	83 - 88	30 < 80 ⁷	95 - 98					
(See Note 5)	HWC			> 25		70 - 135	1000 - 1300	0.8 - 1.4		30 < 80 ⁷	> 88					
STATIONERY ⁸	Banks Bond Copier	0 - 25	100 - 75	0 - 20	- 4	50 - 100 ⁹	580 - 900	(100 - 400)			> 88	40-70 / 30-40	5 - 8	DF 1.3 - 3.0 C 25 - 45		
BANK NOTES	Security	0	100	1 - 3		60 - 100	- 700	(200 - 500)				80-120 / 40-60	8 - 10	DF 3.3 - 3.6 ¹²		
TRACING		0	100			62 - 112	- 1200	(200 - 400)			25 - 40 ⁹	70 / 40	- 3 / 4	- 0	High Aging Resistance	

TABLE 2.2 Typical values of the properties of certain printing and writing grades of paper, taken from various sources (see Chapter 3 for methods of measurement).

[1] Furnish refers only to the fibrous components. Filler content is % total paper. The use of CTMP blurs the distinction.

[2] Standard newsprint is 48.8 g/m². Newsprint is often made from 30 - 100% deinked newspaper and magazines (DIP) which provides 6 - 16% filler. Newsprint made from virgin pulps (85 - 100% mechanical pulp, 0 - 15% chemical pulp) usually contains no filler.

[3] Mainly paper backed books.

[4] Not including the very light special coatings often applied to non-impact printing and self copying papers.

[5] SCA, etc. are abbreviations for "supercalendered quality A", etc. C1, C2, etc. refer to the American grades "coated Number 1", etc. for pigment coated papers which are defined by their brightness and furnish as shown, although the specifications vary. The abbreviations LWC, MWC, HWC (light-, medium- and heavy-weight grammage (42 - 50 g/m²) and coat weight (4 - 8 g/m² per side) ranges. MFP papers (machine finished pigmented) may be in the 50 - 80 g/m² range but with similar low cost weights. The qualities and characteristics of these products vary considerably.

[6] A wider range includes airmail and bible papers, etc. and heavier grades used for records, like ledger paper, card, file cover, etc., say 30 - 220 g/m².

[7] Glossy grades may reach the higher figures. Matt grades may be around 30%.

[8] St: Stiffness mNm; DF: log₁₀ (double folds) Schopper; C: Cobb water absorbiveness for sized papers g/m² 60s.

[9] An opacity measurement is given here for comparison. The transparency of tracing paper is generally measured according to ISO 2469, the industrial standard.

[10] The choice of furnish often depends on the type of mechanical pulp used. With pressure groundwood and thermomechanical pulps, less chemical reinforcing pulp is required, say 15 - 25% rather than 30%, as an example.

[11] Grades for gravure printing usually require more chemical pulp, say 30%, rather than 20 - 25% for example.

[12] Also high aging resistance and 30 - 50% wet strength retention.

Stationery and copier papers are used for numerous business applications. Some of these grades are specifically coated as self copy (auto copy) papers (see Sec. school exercise books) or wood-containing papers, often including recycled fiber. Most papers in this group are largely or entirely wood-free while still including some recycled fiber; these grades must print letterheads well, accept writing and non-impact printing, be erasable and have a good appearance. Envelopes are made from unbleached and bleached papers, often machine glazed (MG) with the smooth side outside.

means that residual ink in delinted stock must not produce a gray or specky appearance. The quality of printing expected by the reader and advertiser is gradually rising. Nevertheless, the greatest technical demands on newsprint are those for trouble-free converting and printing, which is mainly by web offset. Telephone directory paper is essentially lower-weight newsprint, 34 - 38 g/m². The same remarks can be applied to catalogues, magazines and many commercial printing papers with the important difference that the demand for print quality can vary from that of good-quality single-color newsprint to high-quality multicolor halftone illustrations produced by gravure. Mechanical pulps are a suitable furnish for these papers (either entirely or in large proportion) because of their brightness, opacity and lower cost.

When comparing the properties of different grades in Table 2.2, it must be appreciated that the overall subjective assessment of a printed page depends on several objectively measured properties which the image on the printing plate is reproduced on the paper surface is determined by the paper's roughness and ink receptivity and by the uniformity of these properties as they may be affected by formulation and coating. The overall appearance depends not only on the print quality but also on the brightness, gloss and color of the paper, as well as the paper's opacity and resistance to the show-through of images printed on the other side (see reference 8 for example). There is considerable room to maneuver in the formulation of these grades in order to minimize costs. For example, the properties just described can be controlled by varying the proportions of mechanical and chemical pulps, the proportions of long and short-fibered pulps, the amounts and types of fillers and the amounts and compositions of coatings, if any (see Chapter 4).

Paper-backed books are normally printed on mechanical pulp-containing ("wood-containing") filled uncoated papers which print text and simple illustrations well without show-through and at low cost. Books intended to last many years in service require the higher strength and permanence of largely or entirely wood-free papers, neutral sized and if high-quality illustrations are included coated.